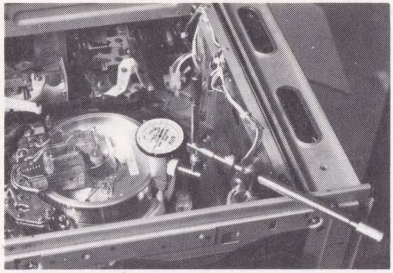
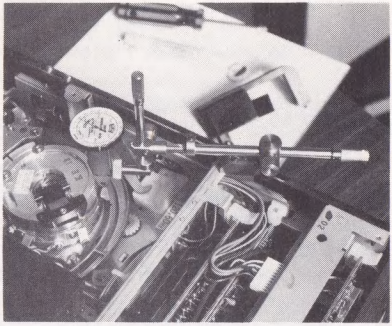
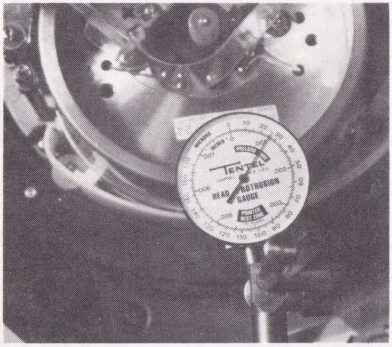
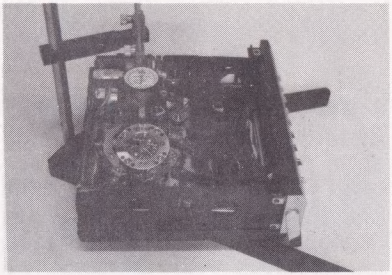


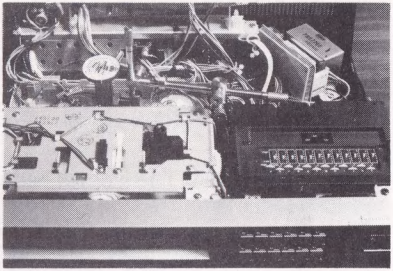


TENTEL

HEAD PROTRUSION and Eccentricity Gauge







Model HPG-1 Instruction Manual

Model HPG-S Addendum

The enclosed instruction manual includes a set of instructions for the original HPG-1. The HPG-1 was designed for measuring head protrusion and eccentricity on 3/4" U-Matic VCR's, as well as early VHS and Beta transports. The HPG-S has been optimized for use on all consumer models of VHS and Beta.

Much of the HPG-1 Instruction Manual will apply to set up of the HPG-S, however please note the following differences:

First, you'll notice that the indicator supplied with the HPG-S differs slightly for the design pictured in the instruction manual. The scale has been reoriented from the top to the side of the indicator to promote easier readings for technicians seated in front of a service bench.

Second, take note of the "straight" faced measuring probe. The sighting grooves on the indicator shoe have been provided to make it easier to align. The plastic measuring probe has also been improved by utilizing a straight face section rather than the original "E" style probe. You must still center the measuring probe over the the upper and lower drum, using the sighting grooves for aiming at the video head tip, as perthe instructions shown in the manual.

We trust you will enjoy these improvements and we welcome your comments

We are currently in the process of revising this instruction booklet so we can offer you the most specific information on where and how to use this Head Protrusion Gauge. We will gladly send you the latest instruction manual as soon as it is completed. Because it would be difficult to track users through purchasing departments, please complete and return the form below to allow us to send it directly to you.

TENTEL Corporation
4475 Golden Foothill Parkway El Dorado Hills, CA 95630

NAME _____

COMPANY _____

ADDRESS _____

CITY, STATE & ZIP _____

PHONE _____

APPLICATIONS _____

TABLE OF CONTENTS

Written by Wayne B. Graham, **TENTEL CORP.**

1. General—Head protrusion is defined as being the amount the head tip projects (thus its alternate name, tip projection) from the scanner drum surface. Head protrusion affects video signal to noise ratio, head life, and skew errors caused by tip velocity errors. It is only because head protrusion has been difficult to measure that head protrusion data has not been widely disseminated allowing technicians an additional input for diagnosing video recorder problems. It would be interesting to know the number of "worn" video heads that have been replaced when the trouble was a clogged or dirty head.
By using the Tentel HPG, video service facilities will be able to provide an additional service by informing customers of approximate remaining head life. This saves the embarrassment of a head life failure shortly after routine service work has been performed.

2. Caution Notes: The Tentel head protrusion gauge is more gentle on video heads than head cleaning. We designed the gauge to virtually eliminate any possibility of harming the fragile video head. There are two cautions which should be understood prior to using the gauge.

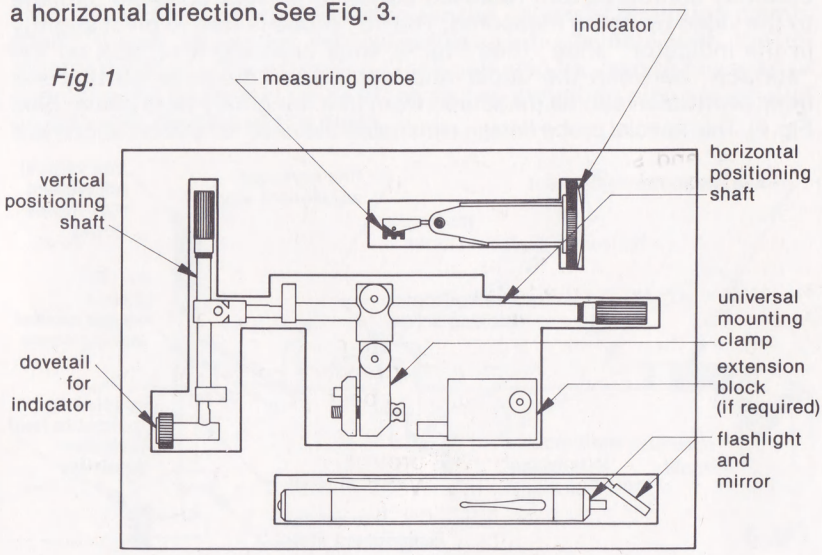
Caution Notes (Cont.)

A. Don't install or remove the gauge from the machine with the measuring probe against a head tip.

B. Don't move the vertical adjustment up or down when the measuring probe is against a head tip.

3. Operating Instructions: Note the gauge as it is shipped in its case, refer to Fig. 1. Familiarize yourself with each of the components in the case, starting with the Universal mounting clamp. By loosening the large (½" dia.) knob on the side of the clamp, the horiozontal/vertical positioning shaft assembly can be removed. The clamp can be mounted to various configurations of sheet metal on the machine to allow readings to be made, See Fig. 2. The clamp should be mounted to sheet metal that appears to be the most rigid, usually near a corner or where there is a junction connecting it to another member. The clamp should be tightened with a 1/8" dia. pin to grip firmly to the sheet metal. It sometimes may be necessary to remove wire clamps, tape guides or similar obstructions to enable the clamp to be positioned properly; don't be alarmed, removal of these types of components won't affect readings. The horizontal/vertical positioning shaft assembly can be clamped from any of three directions into the universal mounting clamp thus enabling the longer (horizontal) shaft to be in a horizontal direction. See Fig. 3.

Fig. 1



The indicator (see Fig. 4) assembly mounts to the dovetail and lock nut (see Fig. 3) by sliding the straight dovetail down into the dovetail holder and locking it into position with the knurled nut. Note that this dovetail provides an additional vertical adjustment of approximately 1¼" (32mm).

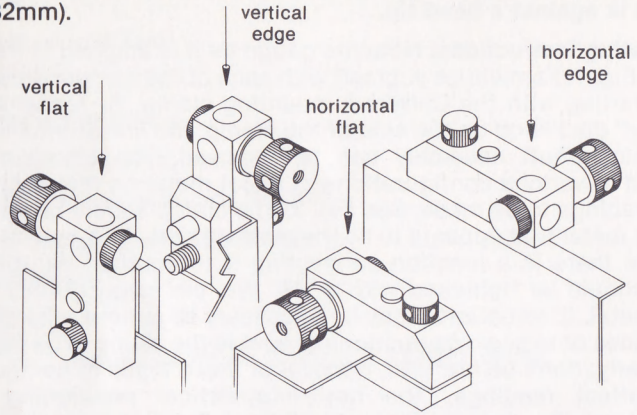


Fig. 2

The measuring probe is constructed of a special plastic with carefully contoured and radiused edges to prevent possible damage to the video tip being measured. The "E" probe is free to pivot slightly in the indicator "shoe" (See Fig. 4), thus enabling it to pick up the "surface" between the upper and lower drum surfaces so that the head protrusion can be measured from this imaginary tape plane, (See Fig. 6). This special probe design eliminates the need for critical alignment

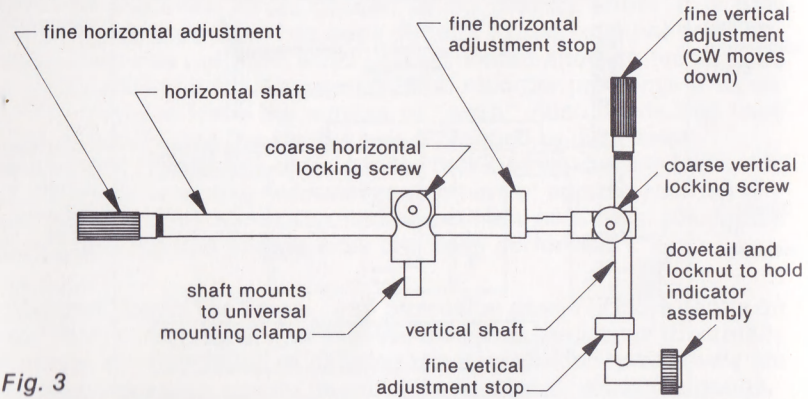


Fig. 3

of the measuring probe with the video head which has been the weak link in prior head protrusion measurement techniques. Visual alignment is totally adequate for proper alignment of the Tentel HPG.

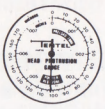


Fig. 4

There are several additional accessories provided in the case, See Fig. 5.

The extension block, although normally not required, can be inserted between the universal mounting clamp (See Fig. 1) and the shaft which normally mounts to the universal mounting clamp (See Fig. 3). This extension block is used to raise the horizontal/vertical positioning shaft and indicator assembly if the video head is less than 1½" below the mounting location for the universal mounting clamp. (Don't forget about the vertical adjustment available with the indicator dovetail.) The extension block can also be used to increase or decrease the horizontal range since its two mounting pins are located on different centers in the block.

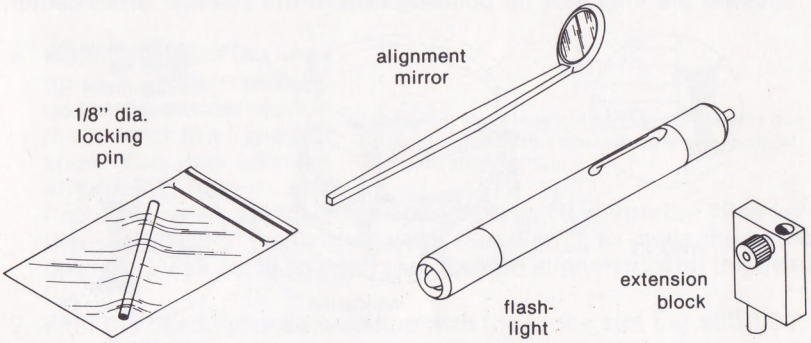


Fig. 5

The alignment mirror and flashlight are helpful for sighting the video tip with the groove on the side of the indicator "shoe" and to establish that the tip is located properly under the center portion of the indicator tip.

3A. Measuring Head Protrusion: Now we are familiar with the components; let's try them on a recorder!

1. Unplug the recorder from its power source. (AC or DC)
2. Remove the top cover from the recorder.
3. Determine what areas on the side of the video drum are suitable for head protrusion measurements. (See Fig. 6) Since the helical scan design usually has the lower drum machined as a tape guide establishing the helical path, locate an area where at least ¼" (6mm) of lower drum has been machined, (See Fig. 6) thus allowing the indicator measuring probe to contact this machined area establishing the tape plane.
4. Locate a rigid portion of sheet metal chassis radially outward from this head measurement zone, preferably near a junction where two pieces of sheet metal are joined together. Mount the universal mounting clamp firmly to this sheet metal.
5. Rotate the head drum to remove any head tips from the head measurement area.
6. Mount the horizontal/vertical positioning shaft assembly, with the indicator assembly mounted in the dove tail, to the universal mounting clamp. With a combination of adjustments using the coarse horizontal, coarse vertical, vertical dovetail, (See Fig. 4) and "leaning" (See Figs. 7 & 9) ability of the horizontal and vertical shafts locate the indicator tip pointing toward the scanner drum center,

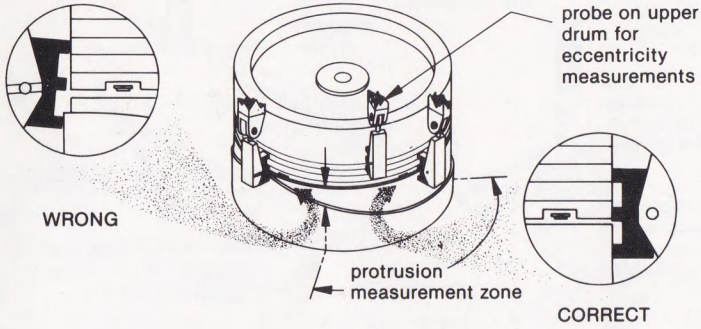


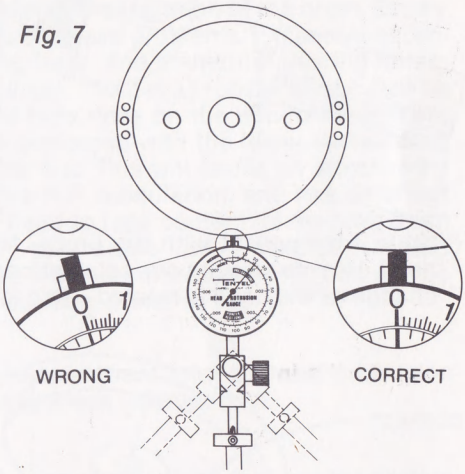
Fig. 6

See Fig. 7, and approximately 1/32" (1mm) from the location where the head tip will be when rotated beneath the indicator probe. Firmly tighten all the mounting clamps and coarse locking screws before rotating the head tip into alignment with the measuring probe.

7. The indicator shoe (Fig. 4) should be moved so that the rear straight edge of the "shoe" is visually parallel with the head drum surface, (see Fig. 8). To accomplish this, simply grasp the indicator body in one hand while using the other hand to move the "shoe" into parallelism with the head drum surface, The vertical shaft and horizontal shaft can be "leaned" or rotated slightly in their mounts by loosening the coarse locking screws. The indicator shoe (See Fig. 4) should be visually aligned with the video drum surface in all directions; refer to Figs. 6, 7, 8 and 9. Remember to tighten the coarse locking screws after performing these alignment procedures.

   Use the fine vertical and horizontal adjustment knobs to again make the "E" probe approximately 1/32" (1mm) away from the video drum surface.

Fig. 7



Horizontal shaft may not be aligned straight due to interference with components in the recorder and mounting location

8. Manually rotate the head tip to a position directly under the narrow slot on the side of the indicator shoe. You may use the alignment mirror and flashlight as an aid for proper positioning. Now turn the "fine vertical adjustment" knob clockwise, (See Fig. 3) to move the probe down and visa versa to bring the slot into alignment with the head tip.
9. With the head tip directly in line with the probe slot but still 1/32" away, manually rotate the drum so that the head tip is *not* beneath the measuring probe.

10. Using the "fine horizontal adjustment" (See Fig. 3) rotate the knob clockwise moving the indicator pointer from its initial "rest zone" location to somewhere in the "preload zone" position. (See Figs. 4, 7, & 8). This places approximately 15 grams of force on the indicator probe to establish the tape plane surface of the upper and lower drum.

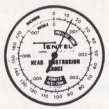
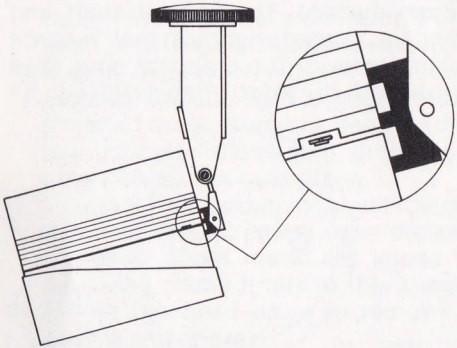


Fig. 8



11. Do not lean on the machine during measurement, but slowly and carefully rotate the head drum, noting the "base circle" measurement of the head drum prior to contacting the head tip. Usually the reading goes lower just prior to the head tip coming into contact with the probe; do not use this lower reading, calculate the difference between the base circle and the maximum with the head tip in engagement with the probe. Make several rotations of the head drum to check your calculations. Note: The base circle may change as the head is rotated—this is influenced by the head drum

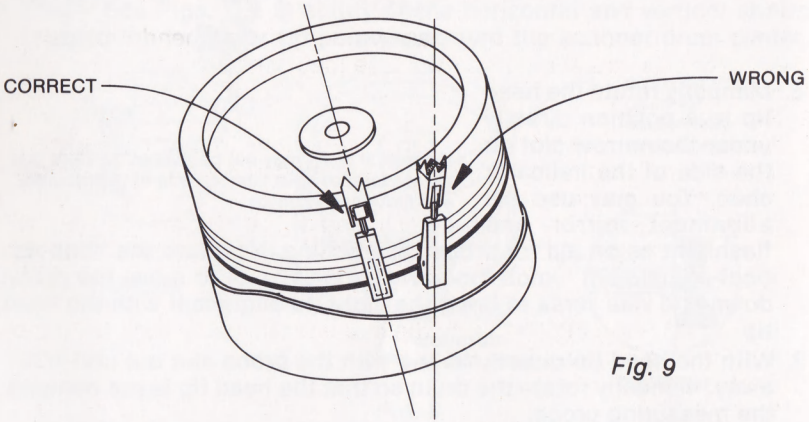


Fig. 9

eccentricity and will be covered in section 3B. A good way to keep track of head protrusion readings is to maintain a record of these measurements by head, machine serial number, and date. The color of the wires leading to the head (red/white, red/red. etc.) can usually be used to identify the various head tips on the scanner drum. If you choose to mark the heads 1,2 etc. with a magic marker, do NOT mark on the outer portion of the scanner drum.

12. Rotate the heads away from the measuring probe. You may now either continue to section 3B to measure head drum eccentricity or you can carefully remove the gauge from the machine.

3B. Measuring Drum Eccentricity: Drum eccentricity is defined as the amount the drum deviates from a circular form or when the centerline of the drum is different from the center of rotation of the drum. Eccentricity affects a number of potential head problems. Excessive eccentricity can cause undue slip ring wear, and premature bearing failure due to an out-of-balance head drum. The head protrusion can also be affected; since a portion of the tape rides on the non-rotating lower drum, one head will rotate low compared with the lower surface and the other head will rotate further out. This will cause an effective tip velocity error and may affect the R.F. modulation, and has an effect on signal to noise ratio due to head to tape contact. Measuring drum eccentricity is essentially the same as head protrusion measurements except the entire indicator measuring probe should be positioned on the upper drum surface. (Refer to Fig. 6)

If you are performing this measurement prior to head protrusion measurements you should follow these instructions;

1. Same as 3 A 1
2. Same as 3 A 2
3. Select a location which allows no obstructions that would interfere with the indicator and also allows mounting of the gauge to a rigid sheet metal portion on the machine.

   On some machines, particularly Betas, it may be necessary to remove tape guides or threading tracks to provide for adequate space.
4. Same as 3 A 4
5. Same as 3 A 6 except position the indicator tip completely onto the upper drum surface, See Fig. 6.
6. Same as 3 A 7
7. Same as 3 A 10

8. Do not lean on the machine, but slowly and with a continuous, steady motion, rotate the head drum, noting the reading variation on the indicator. Typically 8 microns (.0003") of motion is considered maximum. Some machines have no provision for correction and the head drum must be rejected as out of tolerance for eccentricity. Most U-matic and some Beta recorders do allow eccentricity corrections to be made. Follow the manufacturer's service manual for these corrections. A reading of 2 or 3 microns is "virtually perfect."
9. To remove the gauge from the machine see instruction 3A - 12.

Congratulations — It will be a lot easier next time, but do make sure to remember the two cautions in section 2; they may keep you from "losing your head."

It would be next to impossible to claim that the Tentel HPG-1 will fit 100% of the various Beta, VHS, and U-matic recorders ever to be produced. The gauge has been tested on most of the common types of machines. Many of the newer consumer VCR's are built to be inexpensive and lightweight. For these types of VCR's, Tentel has developed an accessory stand which provides an easy, convenient mounting method. The VCR is actually placed onto the base of the stand; the HPG-1 is then mounted to an adjustable horizontal arm which mounts to a rigid vertical post, extending from the stand base. The stand may be preferred by customers who perform many head inspections per day as a method of saving a couple of minutes from the time utilized in mounting the HPG.

4. "Normal" Head Protrusion Readings— Ideally HPG measurements would be made when the machine or heads are new and a record kept to monitor the amount of wear. New head protrusion will vary somewhat depending on the drum diameter. We have seen close to a 50% variation in head protrusion on new video heads. Essentially what this means is that there may be less life (hours) on some new heads compared with others. If possible you should monitor head wear approximately every 400 to 500 hours. We have head life stories of as low as 500 hours (something was really wrong) to as high as 4000 hours. We believe the "normal" to be close to 2000 to 3000 hours. "Normal" is quite hard to define since it is a subjective point where the signal to noise ratio drops to an unacceptable level or interchange is affected beyond the correction capability of the video monitor being used.

We can provide guide lines that we believe will be proven as more data is gathered. (We would appreciate your findings to include in updated versions of this manual.)

Readings shown in Inches (microns)

	Lowest (could go anytime)	Lowest Good (marginal)	Typical (good)	Highest Good (probably new)
U-Matic	.0010 (25.4)	.0013 (33)	.0018 (46)	.003* (76)
VHS	.0005 (13)	.0007 (18)	.0015 (38)	.0018 (46)
BETA	.0002 (5)	.0005 (13)	.0012 (30.5)	.0018 (46)

*Flying erase heads are approx. .0014" (35μ) when new.

Since tip velocity is the most important factor for tape interchange (assuming tape tension is held constant) the following equation shows the relative importance of various factors for establishing head tip velocity.

Tip Velocity (in./sec.) =

$$\frac{\text{head drum RPM} \times \pi \times 2 \times \left[\frac{\text{Drum dia.}}{2} + \text{Head Protrusion}\right] \pm \frac{\text{Drum Eccentricity}}{2}}{60}$$

We have measured head drum diameter variations of .0004" to .0005", thus the effect on the "desired" head protrusion would be approximately .0002" (5 microns).

The formula that relates tip velocity and head protrusion to "proper" tape tension is quite complex, so suffice it to say that as tip velocity increases it would be necessary to apply more holdback tape tension to stretch the tape longer so that the relative tip velocity would be correct for playing back the recorded helical path.

5. Trouble Shooting Head Problems: There are a number of problems that can occur with video heads.

a. Normal wear out (See Figs. 10 & 12)
b. Normal oxide build up
c. Clogged head gap
d. Broken ferrite (See Figs. 13, 14 & 15)
e. Broken epoxy holding ferrite to base (See Figs. 13 & 15)
f. Broken head wire (See Fig. 13)
g. Cracked head gap
h. Faulty or dirty slip rings

Misdiagnosing the problem may result in costly premature head replacement. If the head protrusion measures normal but one or both of the video fields are not playing, it may be caused by one of the problems "b" to "h" above. Clean the head carefully and thoroughly to determine if the problem is (b or c), if this does not correct the problem, unsolder the head at its drum connection and test the head for continuity with an ohm meter to determine if the problem is (f). Normally the head resistance will be one to three ohms.

Head Resistance: 1 to 3 Ω

The use of aerosol cleaners containing freon or similar "cold expanding" additives should be avoided. (Spray some on your finger, if it feels icy cold don't use it). We have found a fairly high percentage of head failure caused by epoxy cracking or loosening. (See Figs. 13 & 15). This epoxy failure will allow the ferrite to crack or the gap to open, either of which results in a ruined head. This epoxy "problem" may be the result of harsh solvents or coefficient of expansion differentials among the epoxy, ferrite, and brass base, when aerosol cleaners are used.

Examples of various head conditions are shown in Figs. 10 thru 15. Fig. 10 shows two heads facing each other. You can see the smooth round curve (on the left) of the new VHS head, and in fact it measures .0019" head protrusion. The head on the right shows a well worn VHS head; note the flat curve where the ferrite has worn. This head measured .0005"; indicating nearly 1½ thousandths of an inch had been worn by normal use.

Fig. 11 shows a healthy U-matic head, note the thickness at the head gap compared to the head shown in Fig. 12, which is a similar head worn almost completely thru. Fig. 13 shows two problems; the epoxy has loosened from the brass substrate allowing the ferrite to fracture at the gap; also note a broken head wire on the left side of the tip. Fig. 14 shows a broken ferrite, this probably occured during cleaning but it looks as though the head gap was worn to a very thin weak section prior to the breakage. The Tentel HPG will allow you to measure the protrusion on the remaining head tip(s) if a breakage occurs during cleaning. Just think how much better you'll feel when you determine that the head was nearly worn out anyway. A worn head is weaker and much more likely to break during cleaning. (Compare Figs. 11 & 12)

The Tentel head protrusion gauge should provide invaluable information to anyone attempting to diagnose video head problems. Service facilities can now inform their video cassette recorder service customers of approximate head life remaining, thus preventing "misunderstandings" when a head failure occurs shortly after routine cleaning and service. Persons who must rely on their machines working the first time, such as news and on the spot event coverage will now be able to determine if their heads are worn excessively. This knowledge will enable them to schedule head replacement during non use times.

We would appreciate hearing of video head problems diagnosed and solved with the use of this gauge. We will pass this information on in updated printings of this manual. (A short informal note is sufficient and would be greatly appreciated.)

NOTES . . .

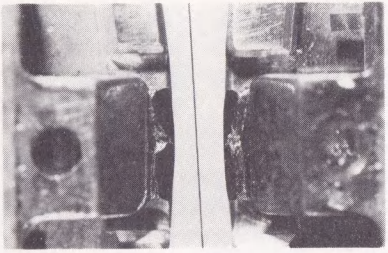


Fig. #10

Two VHS heads side by side for comparison —head on left is new (.0019), head on right is well used (.0005).

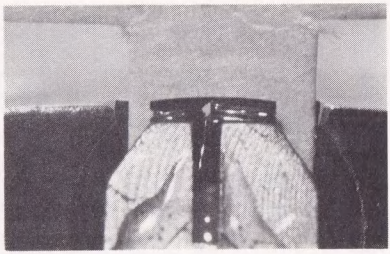


Fig. #11

Healthy U-matic head, note thickness at gap (.0018).

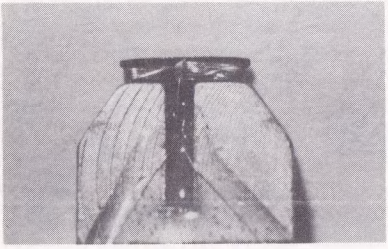


Fig. #12

Well worn U-matic head, gap was about to open.

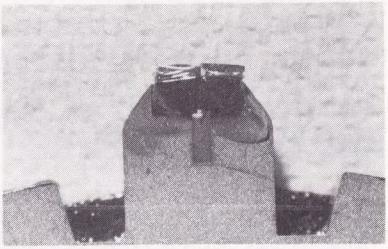


Fig. #13

Damaged head, note epoxy has come away from brass holder, allowing ferrite to crack at gap. Ferrite is chipped off and wire is broken. Wow! It's gone!

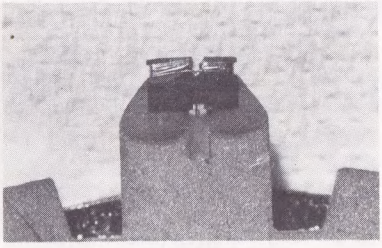


Fig. #14

Damaged video head, probably broken during cleaning due to weakened well worn condition.

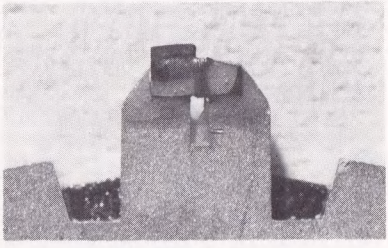


Fig..#15

U-matic flying erase head, shows signs of epoxy cracking and loosening, allowing ferrite to break.

NOTES . . .

		Manufacturer	Model	Serial/No.	Date	Head Info	Comments
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						

REPAIR/SERVICE

The **TENTEL HPG-1** has been designed for years of trouble free, accurate head protrusion readings. The only wear item in the gauge is the special plastic "E" indicator probe. We have performed hundreds of measurements with no loss of accuracy due to probe wear. Slight damage, or scraping, of this probe may occur if the gauge is used repeatedly on a badly broken sharp ferrite. (See Fig. 15). A strong magnifying lens should be used to determine if any damage has occured to the "E" indicator probe face. The probe assembly should be kept clean to allow the plastic probe to pivot easily in its mount.

Check that the dial indicator operates easily without binding or sticking. Check that all locking screws operate smoothly. Do not overtighten locking knobs on the horizontal and vertical positioning shafts, these should be snug but not over tight.

If field repairs cannot be performed satisfactorily, return the complete gauge with accessories and case to Tentel. Tentel shall have the sole responsibility to determine warranty repair work. Please furnish name, address, and phone number of the person to whom correspondence should be directed.

The unit should be returned, shipping prepaid, to:

TENTEL CORPORATION
1506 Dell Avenue
Campbell, CA 95008
Attn: Repair Department
Telephone: (408) 379-1881
*(800) 538-6894
*Cont. U.S. ex CA

LIMITED WARRANTY

The instructions and cautions in this manual should be thoroughly read and understood. With proper care, handling and storage, the Tentel head protrusion gauge should provide years of trouble free, accurate head protrusion readings. When properly used, the HP gauge positively will not damage healthy video heads. The HPG-1 head protrusion gauge is guaranteed to be free of defects in materials and workmanship for a period of one year after delivery to the initial purchaser.

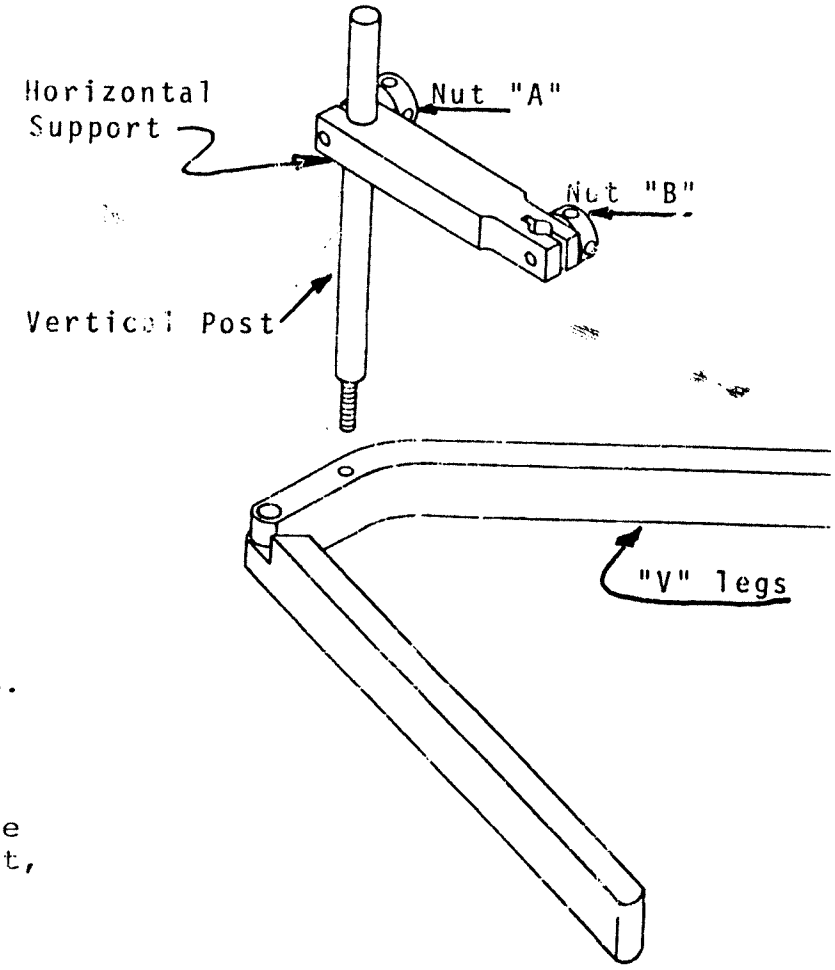
NOTE: This warranty does not cover damage caused by accident, abuse, alteration, disassembly, or failure to follow cautions and instructions. Tentel assumes no responsibility or liability for damage caused by accident or misuse. The enclosed instructions are intended as a helpful guide only and Tentel assumes no liability from its misuse or misapplication.

"S1" Assembly and Use Instructions

The S1 stand is intended for use with the TENTEL Head Protrusion and Eccentricity Gauge, Model HPG-1. The stand is recommended for applications where the universal clamp of the HPG-1 has no suitable mounting location.

Minor assembly of the stand is required.

1. Slide the "Horizontal Support" down onto the "Vertical Post" to approximately one inch (1") above the threaded end. Firmly tighten nut "A" using the 1/8" pin provided. Screw the "Vertical Post" into the "V" legs as shown. Using the "Horizontal Support", tighten the "Vertical Post" firmly into the "V" legs.
2. Use the 1/8" pin to loosen nut "A" and move the "Horizontal Support" up the "Vertical Post", rotate it out of the way and lock it from sliding by tightening nut "A".
3. Position the video recorder on the "V" legs, moving the legs apart or together, as required, to allow the recorder to rest firmly onto the "V" leg surfaces. (Video recorders typically have screw heads and rubber feet protruding from the bottom.)
4. With the recorder firmly in place on the "V" legs, insert the shaft, that would normally go into the universal mounting block, into the 1/4" hole in the outer end of the "horizontal support".



5. Position the "horizontal support" and the HPG-1 to allow the measuring probe to fit onto the video drum to perform the required measurements. Make sure that both "A" and "B" nuts are firmly tightened using the 1/8" dia. locking pin.
6. See the HPG-1 instruction manual for additional positioning information.

NOTE: Make certain that all locking knobs equipped with cross holes are tightened securely with the 1/8" pin, prior to performing head protrusion or eccentricity readings.